

Improvements in and relating to air purification

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Abstract of GB480176

Hypochlorous acid in the form of gas, as distinct from mist or fine aqueous particles, is produced by atomizing a hypochlorite solution by means of a gas operated atomizer with air or oxygen containing sufficient carbon dioxide to decompose the hypochlorite, and is used for purifying air. A hypochlorite solution free from caustic soda and not exceeding in strength 5 grms. of "active chlorine" per litre is preferably used, and the atomizer may be operated by a gas consisting of oxygen mixed with 5 per cent by volume of carbon dioxide, though a part of the air to be purified may be employed if its carbon dioxide content is sufficient. Specifications 414,860 and 480,177, [both in Group XXIX], are referred to. ALSO: Hypochlorous acid in the form of gas, as distinct from mist or fine aqueous particles, is produced by atomizing a hypochlorite solution by means of a gas operated atomizer with air or oxygen containing sufficient carbon dioxide to decompose the hypochlorite, and is used for purifying air. A hypochlorite solution free from caustic soda and not exceeding in strength 5 grms. of active chlorine per litre is preferably used, and the atomizer may be operated by a gas consisting of oxygen mixed with 5 per cent by volume of carbon dioxide, though a part of the air to be purified may be employed if its carbon dioxide content is sufficient. The hypochlorous acid gas is delivered into a space from which a stream of air issues into a chamber or room, for instance at a suitable point in the air circuit of an air-conditioning plant. Specifications 414,860 and 480,177, [both in Group XXIX], are referred to.

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Description of GB480176

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PATENT SPECIFICATION

Application Date: Aug 17, 1936.

No 22641/36.

48 O,176 Complete Specification Left: July 10, 1937.

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PROVISIONAL SPECIFICATION

Improvements in and relating to Air Purification I, ARTHFUS THOMAS MAST Eu RMAN, M A, F.R S, a subject of the King of Great Britain and Ireland, of 10 and 12, Brewery Road, London, N 7, do hereby declare the nature of this invention to be as follows: This invention relates to air purification by the use of hypochlorites or of hypochlorous acid or of these two substances together. These compounds are known to have a very high germicidal and oxidising power when acting in the liquid state and are widely used for these purposes.

Attempts have also been made, by exposing solutions of these liquids, to purify the air by evaporation of hypochlorous acid in a gaseous form either as such or released from hypochlorites.

Air purification by this means on a sufficiently extensive scale to give practical results has not, so far as I am aware, been attained on account of the difficulties involved. The hypochlorites are not volatile in solution and the only hypochlorous acid gas available for evaporation is the small quantity present in solutions of hypochlorites due to hydrolysis and such further quantities as might be produced by the contact of the small quantities of carbonic acid gas found in the atmosphere.

s O The addition of certain acids such as acetic or phosphoric acid will result in larger quantities of free hypochlorous acid in solution but there still remains the problem of setting this gas free and disseminating it through the atmosphere.

Again, it is practically necessary to avoid dissemination of unvapourised liquid on account of its damaging effect on many materials it may come in contact with.

Also it must have no toxic effect on human beings or domestic animals.

The object of the present invention is to provide a process for the purification of air by the use of hypochlorites or hypochlorous acid or both free from the disadvantages indicated above and thereby to effect practical sterilisation of the atmosphere of enclosed spaces in human occupation, e.g. chambers or rooms, without discomfort or danger to the occupants.

I find that if a hypochlorite in solution or suitable suspension or hypochlorous acid solution be passed through a form of atomizer in which the "solution" is sprayed, and broken up into fine particles 55 and vaporized by the action of gas-jets, either atmospheric gases or special mixtures, as e.g. oxygen and carbonic acid, the hypochlorous acid (or allied chemical compounds) is set free and diffused through 6 G out the atmosphere in a very short time; in other words is satisfactorily disseminated.

The invention consists in a process or method of sterilising occupied spaces, rooms and the like by the dissemination 65 of hypochlorous acid gas or the like as indicated in the preceding paragraph or by some analogous manner, attention being paid to the choice of suitable concentrations, for instance as indicated 7 (Q below).

In carrying the invention into effect in one form by way of example as applied to the sterilisation of a room of, say 10000 cubic feet which may be occupied by twelve 75 persons, a hypochlorite solution of 2 grams per litre of active chlorine is employed in a scent spray type of device, e g that of Patent Specification No 414,860 The liquid is sprayed by a supply of air under 80 pressure as from a cylinder The air supplied should have a definite carbon dioxide content.

The spraying device is arranged to spray into a space through which a definite 85 stream of air is passing impelled by a fan or other air circulating device.

The sprayer is adjusted to give a definite supply of mist for mixing with the air stream, this adjustment being limited to 90 give a predetermined maximum local concentration.

It is found that in this way the bacterial content of the room can be reduced by % to 90 % in about one hour Further 95 it is found that the maximum concentration can be so chosen that this result is obtained and maintained without irritation, disturbance or other prejudicial effect upon the occupants of the room 100 GEN Ei RAL.

The gas may be supplied by air-compressors, in which ease the hypochlorous acid is set free in the solution by the carbonic acid gas contained in the air and swept 105 out of the solution by the air.

480,176 I find that if cylinders of compressed gases are used it is advantageous to employ a mixture of oxygen and carbonic acid gas (95 to 5), the latter gas causing an active decomposition of the hypochlorite with production of the gaseous hypochlorous acid.

Any type of atomiser made of materials immune to the corrosive action of hypochlorites may be employed.

It is found that the active gas or gases produced by this method are almost without smell and can be inhaled without irritation, provided that the strength of the straying liquid in active chlorine does not exceed about 5 grammes per litre.

Extensive experiments have shown that by varying the strength of hypochlorite in "active chlorine" the atmosphere of a given enclosed space can be cleared of smoke and of organic emanations and can even be rendered sterile of all air-borne germs.

In a room containing 2000 cubic feet of air, by spraying with a hypochlorite solution of 11 gins per litre of "active chlorine," complete sterility can be obtained in three to four hours The maximum amount of "active chlorine" which could have been set free in the air was 30 7.7 gms representing a concentration of not more than 3 85 milligrams per cubic foot of air.

In air-conditioning plants the atomizer may be inserted at any convenient stage 35 in the air circuit The greater the quantity of carbonic acid gas present in the "used" air the more active it will be in decomposing the hypochlorites and setting free the hypochlorous acid gas 40 In contrast with air treatment by means of water the present invention gives a germicidal effect In contrast with air disinfection by formaldehyde, sulphur dioxide, chlorine, or ozone, there is no need 45 to remove the disinfectant after air treatment for sterility before the air is fit for breathing purposes.

Dated this 17th day of August, 1936.

MARKS & CLERK.

COMPLETE SPECIFICATION

Improvements in and relating to Air Purification I, ART Hu R TH Om IAS MASTERMTAN, M A, i F.R.S, a subject of the King of Great Britian and Ireland, of 10 and 12, Brewery Road, London, N 7, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:-

This invention relates to air purification by the use of hypochlorites or of hypochlorous acid These compounds are known to have a very high germicidal and oxidising power when acting in the liquid state and are widely used for these purposes Attempts have also been made, by exposing solutions of these

liquids to purify the air by evaporation of hypochlorous acid in a gaseous form either as such or released from hypochlorites.

Air purification by this means on a sufficiently extensive scale to give practical results has not, so far as I am aware, been attained on account of the difficulties involved. The hypochlorites are not volatile in solution and the only hypochlorous acid gas available for evaporation is the small quantity which might be produced by the contact of the small quantities of carbonic acid gas found in the atmosphere.

The addition of certain acids such as acetic or phosphoric acid will result in larger quantities of free hypochlorous acid in solution, but there still remains the problem of ensuring vaporisation of this solution for the purpose of setting the gas free and disseminating it through the atmosphere, and that of the disadvantages attendant upon the dissemination of unvaporised acid liquor, such as its damaging effect on many materials with which it may come into contact and its toxic effect 90 on human beings or domestic animals.

The object of the present invention is to provide a process for the purification of air on an extensive scale by the use of hypochlorites or hypochlorous acid free from 95 the disadvantages indicated above for instance damage to the materials and to human beings or domestic animals exposed to the air and thereby to effect practical sterilisation of the atmosphere of enclosed 100 spaces in human occupation, e.g. chambers or rooms, without discomfort or danger to the occupants or damage to the materials therein.

I find that if hypochlorous acid be 105 produced from a hypochlorite solution and be vaporised by the action of gas-jets, either atmospheric gases or special mixtures, and atomised into the air in the form of vapour, i.e. gas, as distinct from 110 fine aqueous particles such as mist, the hypochlorous acid gas may be diffused or satisfactorily disseminated to obtain a high degree of purification of the air without the damage to materials or dis 115 comfort or danger to occupants referred to above.

In contrast with air treatment by means of water the present invention gives a 480,176 germicidal effect In contrast with air disinfection by formaldehyde, sulphur dioxide, chlorine, or ozone, there is no need to remove the disinfectant after air treatment for sterility before the air is fit for breathing purposes; it being known that the minimum lethal concentration of the i above reagents for certain bacteria approximates to that for the human subject i The invention consists in the production, for purifying air, of hypochlorous acid vapour, i.e. gas, as distinct from mist or fine aqueous particles by atomizing a hypochlorite solution by means of a gas lb operated atomizer with air or oxygen containing sufficient carbon dioxide to decompose the hypochlorite.

In carrying the invention into effect in one form by way of example as applied to the sterilisation of the air in a room of, say, 10000 cubic feet which may be occupied by twelve persons a sodium hypochlorite solution of a strength equivalent to 0.2 per cent by weight of active chlorine is employed in a scent spray type of device as shown in the Specification of my copending Patent Application No 22642 of 1936, (Serial No 480,177) The liquid is sprayed by a supply of natural air through an air compressor or a hand pump or by "artificial air" under pressure from a cylinder The natural air or "artificial air" supplied must have such a carbon dioxide content as to decompose the sodium hypochlorite in the liquid which is sprayed, thereby releasing the desired amount of hypochlorous acid without the production of free chlorine gas When the natural air from the room to be treated is used for spraying the liquid, the greater the number of persons present in the room the more efficient will be the air of the room for this purpose.

The hypochlorous acid gas producing device is arranged to deliver into a space through which a definite stream of air is passing impelled by a fan or other air circulating device.

The gas producing device is adjusted so that complete evaporation of the liquid takes place that is to say so that only gas as distinct from mist or other fine particles of liquid is emitted and the dissemination of unvaporised liquid droplets is completely avoided, with the benefits referred to above, this adjustment being limited to give a predetermined maximum local concentration.

GENERAL.

I find that if cylinders of compressed gases are used for producing the hypochlorous acid gas it is advantageous to employ a mixture of oxygen and carbonic acid gas (95 to 5), the latter gas causing an active decomposition of the hypochlorite with production of the gaseous hypochlorous acid.

Should a gaseous mixture be employed with a high concentration of carbonic acid gas for producing the hypochlorous acid 70 G gas, there is a tendency for production of free chlorine gas which is liable to cause irritation to occupants of the room the air in which is being sterilised.

Most hypochlorite solutions contain large 74 quantities of caustic soda, which must be neutralised by the carbonic acid gas before any hypochlorous acid gas can be set free.

It is therefore necessary or at least desirable to employ a hypochlorite free of caustic 80, soda.

This is an important factor in employing natural air, in which the content of carbonic acid gas is very low.

Any type of atomiser capable of producing 855 vapour (i e gas) as distinct from liquid droplets and made of materials immune to the corrosive action of hypochlorous acid or hypochlorites may be employed.

It is found that the active gas or gases 90 produced by this method are almost without smell and can be inhaled without irritation provided that the strength of the spraying liquid in active chlorine does not exceed about 5 grammes per litre 95 Extensive experiments have shown that by varying the strength of hypochlorite in " active chlorine " the atmosphere of a given enclosed space can be cleared of smoke and of organic emanations and can 100 even be rendered sterile of all air-borne germs.

It is found that in this way the bacterial content of the room can be reduced by 80 % to 90 % as a result of one hour's spraying 105 Further it is found that the maximum concentration can be so chosen that this result is obtained and maintained without irritation, or disturbance of the occupants or other prejudicial effect upon the contents 110 of the room.

In a room containing 2000 cubic feet of air, by spraying with a hypochlorite solution of 11 grammes per litre of " active chlorine," sterility can be obtained in 11 i 5 three to four hours The maximum amount of " active chlorine " which could have been set free in the air as estimated by the amount of liquid which was vaporised was 7 7 grammes representing a 120 concentration of not more than 3 85 milligrams per cubic foot of air.

In air-conditioning plants the gas producing device may be inserted at any convenient stage in the air circuit 125 Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be

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